CEMENT AND LIME MANUFACTURE

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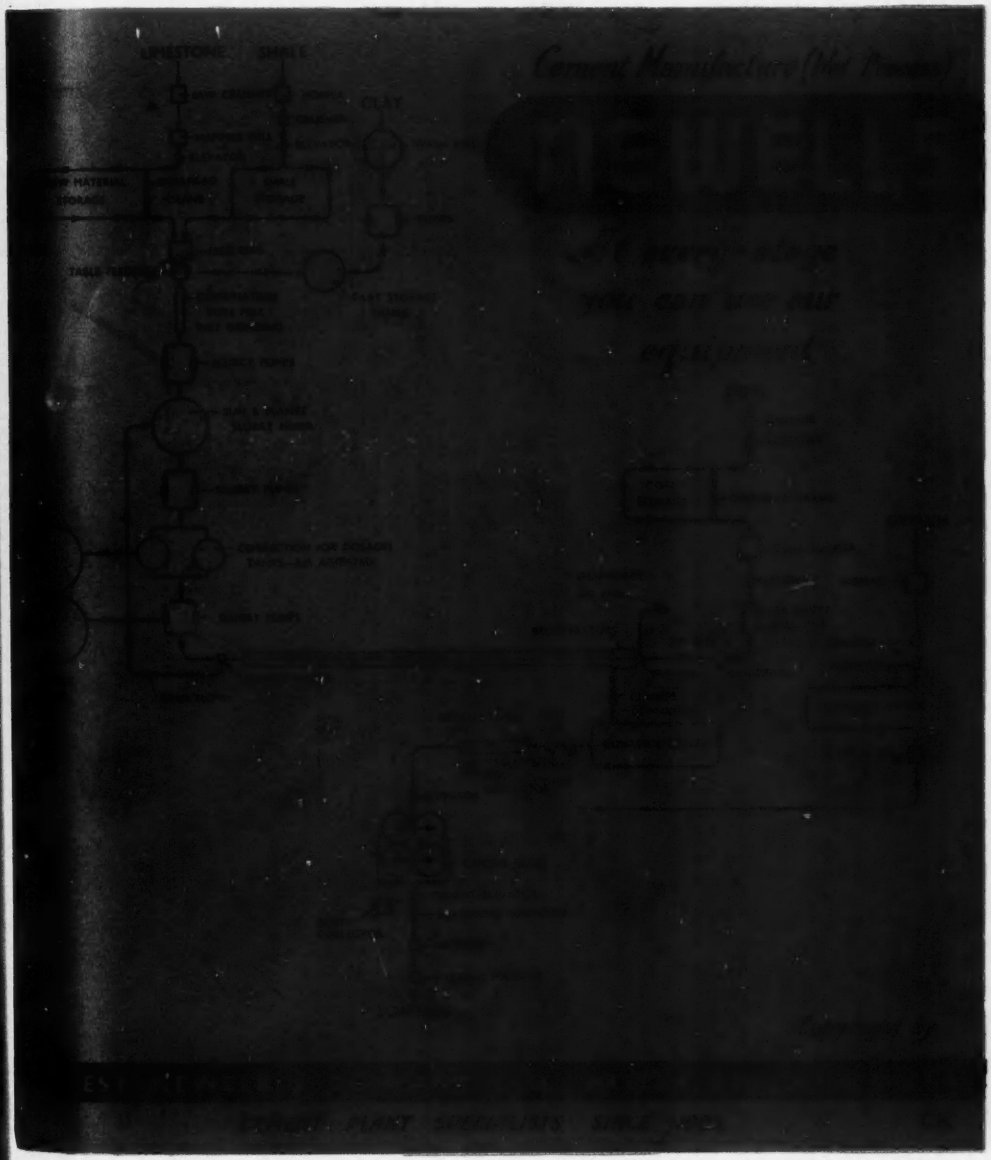

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Cement manufacturers were the first to realize the possibilities of a paper sack. Millions of multiwall sacks are supplied by Bowaters every year to this one industry alone.

Over 300 go in multiwall sacks

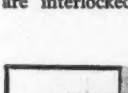
CLEANER TRAVEL TREND CONTINUES

SINCE the cement industry first adopted multiwall sacks some 25 years ago, design and use of these adaptable containers have developed considerably.

Today multiwall sacks are used for the efficient bulk packing and transport of over 300 different commodities. Among them you will find sugar and other food-stuffs, industrial and fine chemicals, carbon black, granular plastics and moulding powders, ground rock products, animal feeding stuffs and fertilisers. All now depend for safe, clean—absolutely clean—transport on the adaptable, ubiquitous multiwall sack.

Bowaters multiwall sacks are made in three basic types: pasted valve, sewn valve and sewn open mouth. In making the economical pasted valve sacks, Bowaters use a unique "stepped-end" method, whereby the plies are interlocked and glued to give extra strength. For costly and delicate materials, sewn valve sacks are generally preferred. Both pasted and sewn valve sacks are suitable for modern high-speed filling equipment, the valve sealing the sack after filling. An external or internal sleeve may be used to give full protection against sifting or infiltration. Sewn open mouth sacks are for commodities which cannot easily be packed into valve sacks. They are closed by bunching and tying or, for complete closure, sewing.*

Goods in transit or storage are at the mercy of foreign filtering bodies, the ravages of pests, chemical action, moisture-vapour, damp conditions, deterioration and contamination. Bowaters multiwall sacks can be reinforced by 'special property' papers which may be coated, impregnated, lined or laminated with resistant materials and substances to protect them from every one of



For information and advice on any aspect of packaging, please write to:

Divisional Sales Manager, Packaging Division, Bowater House, Stratton St., London, W.1. GRO. 4881

** By arrangement with the main British distributors, Bowaters are the only paper sack manufacturers in the United Kingdom to supply the United Special Sewing Head, generally recognised to be the best in the world.*

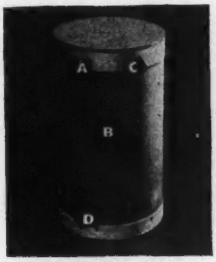
Meet a Drum

This is the Bowaters Pattern 1 fibre drum —of particular interest to the cement industry as a safe and sure method of transporting cement waterproofing compounds, flooring compounds, refractory cements and other of the more delicate and costly products of the industry from factory to building site.

Polythene liners, specially tailored to fit this drum, make it possible to pack hygroscopic and corrosive materials in absolute confidence of safe transit and arrival.

These are the vital statistics about the Pattern 1 drum:

Inside diameters from 9" to 22¼"; internal heights from 8" to 34" according to capacity required. Passed by Railway Clearing House to carry up to 3 cwt., according to diameter.



DRUM FEATURES

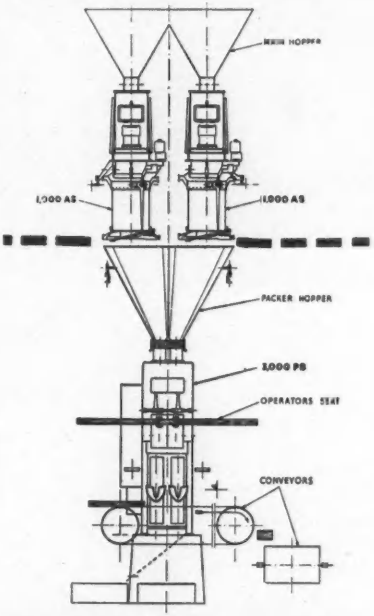
- **A** Full open top—easy to close and reclose.
- **B** Wall and end strength of not less than 300 lb. per square inch.
- **C** Easy to seal.
- **D** Rolling chime reinforced with kraft ring.

these hazards. A polythene-coated ply, for instance, may be used as a liner to insulate hygroscopic and deliquescent products. Special water and grease-proof plies are also available.

The adoption of multiwall sacks has raised standards of hygiene and protection to a remarkable degree. Bowaters welcome enquiries from manufacturers who would like to be shown the advantages of the multiwall sack applied to their special problem.

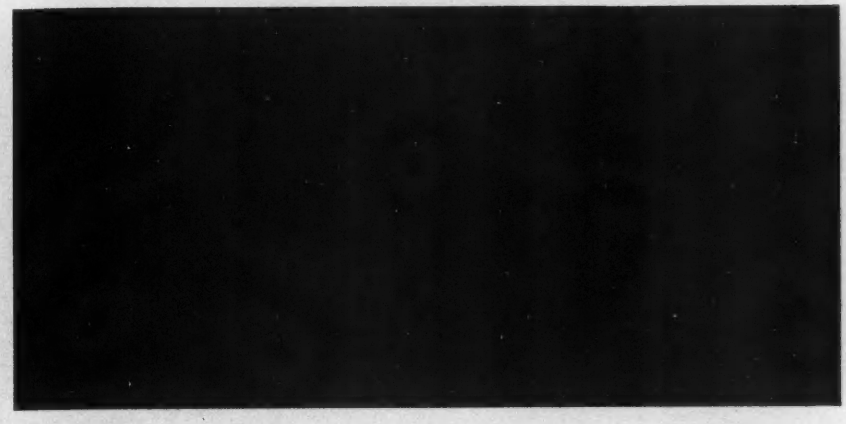
This Automatic Scale gives 99.9% accuracy

The Bowaters 1,000 A.S. Automatic Scale is designed to weigh, quickly and accurately, free and semi-free flowing granular or crystalline materials with the minimum attention. Two of them working with the Bowaters 3,000 P.B. Packer make an ideal packaging team. Typical performances: granular fertilisers, 20 tons an hour in one cwt. weighings; sugar, 15-18 tons an hour in one cwt. weighings; accuracy in both cases ± 2 oz. in one cwt.



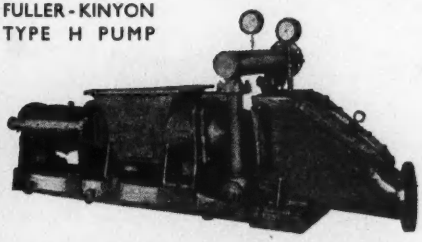
With this new packer one man can fill 720 sacks of granular fertiliser an hour

By simply pressing buttons one man operating Bowaters 3,000 P.B. Packer can pack 36 tons of granular fertiliser into 1-cwt. sacks — that's 720 sacks an hour. This efficient machine will pack any free-flowing granular or crystalline materials, pre-weighed on automatic weighers, preferably Bowaters 1,000 A.S. Automatic Scale. There is a special leaflet about the 3,000 P.B. machine which is well worth seeing. Please write if you would like a copy.



EMINENTLY SUITABLE FOR THE EFFICIENT CONVEYING OF CEMENT AND RAW MATERIAL FROM MILLS TO SILOS

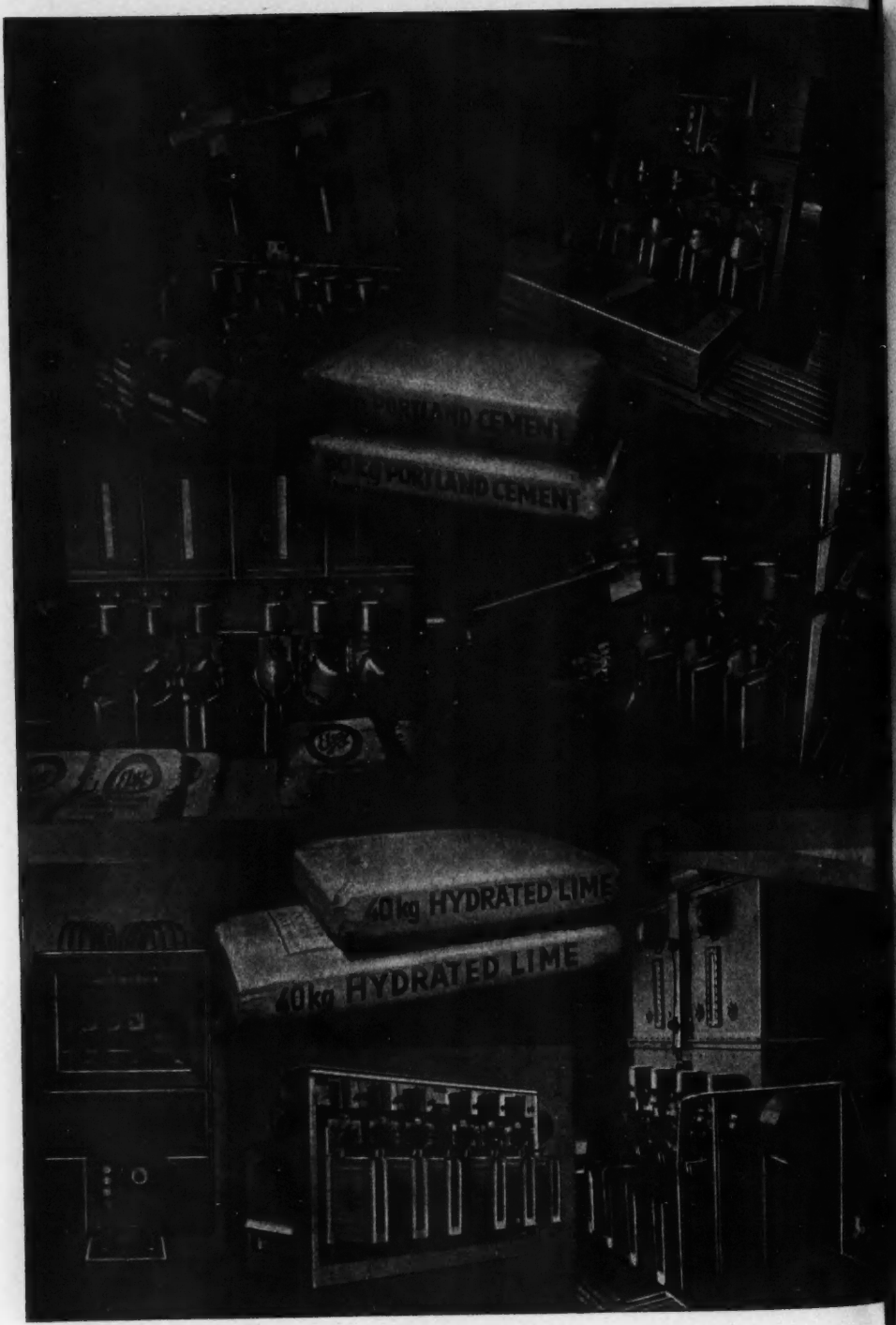
FULLER-KINYON
TYPE H PUMP



FULLER-KINYON PUMP IS INSTALLED AT MASON'S CEMENT WORKS

With the Fuller-Kinyon Pneumatic Conveying System direct savings result from operation with the minimum of supervision, as materials can be conveyed literally anywhere a pipeline can be run. Lay-outs of new cement plants can be considerably simplified and old plants modernised without interference with existing buildings and equipment. Materials can be pumped economically far beyond the practical limits of mechanical systems.

The F-H Airslide conveyor can be used in conjunction with the Fuller-Kinyon system for silo discharge and handling of cement for road or rail deliveries. The F-H Airslide contains no moving parts, and maintenance costs and power consumption are low.
These systems are used universally and ensure dust-free and accident-free conditions throughout the plant. Full technical details are available on request.



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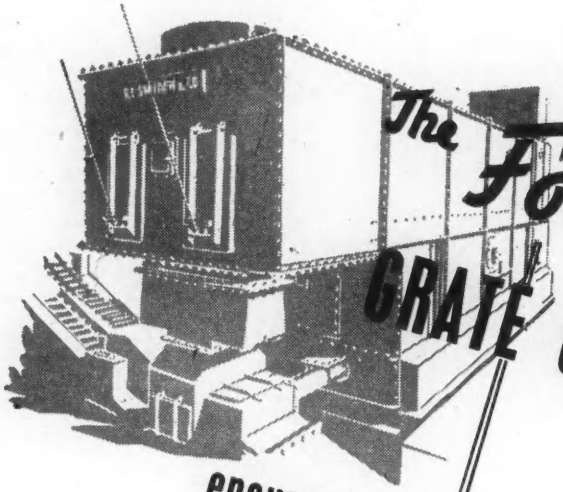

The Folax GRATE COOLER

ensures flexible kiln operation...

The amount of air penetrating the bed of the FOLAX GRATE COOLER can be adjusted independently of the amount of air required for the burning in the kiln, and the cooler and kiln speeds are independent of one another.

Other features are efficient heat recuperation, air quenching, effective cooling permitting immediate grinding, low head room, low power consumption and small maintenance cost.

The FOLAX GRATE COOLER—the cooler with horizontal grate and positive conveying of the clinker—is supplied by :

F. L. SMIDTH & CO. LTD.

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Extension of Mason's Cement Works, Suffolk.

WHEN Mason's cement works at Claydon, Suffolk, started production over forty years ago its capacity was 20,000 tons a year. Additional plant was installed and in 1948, when the works was purchased by the Blue Circle group, the annual output was about 50,000 tons. Improvements to the existing plant were then carried out which resulted in an increased capacity of over 10,000 tons in 1949. Extensions have now been completed (*Fig.* 1) and the capacity is over 175,000 tons a year.

The clay is obtained about one mile from the works; the quarry is shown in *Fig.* 2. It is boulder clay of the glacial period, and differs from most other clays used for cement manufacture in Great Britain in that it contains about 45 per cent. of $CaCo_3$ in the form of hard nodules of pure chalk embedded in the clay;

Fig. 1.—Mason's Cement Works, Claydon.

this reduces the additional amount of chalk required. The clay is excavated by a mechanical face-shovel and transported to a 120-h.p. washmill which rotates at 24 revolutions per minute and washes the clay at a rate of 40 tons per hour. The slurry from the washmill has a water content of 55 per cent. and is pumped through a 6-in. pipe by one set of 12-in. diameter plunger pumps, with strokes of 15 in., a distance of about 3500 ft. to storage tanks near the chalk washmills.

The chalk washmills are situated in the chalk quarry (*Fig.* 3), which is about half a mile from the works. The chalk is excavated by a face shovel at a rate of 80 to 100 tons per hour. It is then transported about 300 yd. and tipped into a rough washmill of 30 ft. diameter, rotating at 13 revolutions per minute, driven by a 170-h.p. motor. Here the clay is added to the chalk. After passing through $\frac{1}{16}$-in. mesh sieves the slurry flows to a secondary mill of 23 ft. diameter driven

Fig. 2.—The Clay Quarry.

Fig. 3.—The Chalk Quarry.

by a 120-h.p. motor rotating at 24 revolutions per minute. This mill is lined with screens with holes of 0·75 mm. diameter.

From the secondary mill the slurry is pumped a distance of 3000 ft. by two sets of high-pressure plunger pumps of 10½ in. diameter and 20 in. stroke through an 8-in. pipe to three correction tanks seen to the right of *Fig.* 1. In the correction tanks the slurry, with a moisture content of 41 per cent., is corrected for chemical composition before it flows to the kiln-feed tank. From this tank, in which it is kept agitated both by air and mechanical means, the slurry is pumped to a spoon-feed at the back end of the kiln.

Fig. 4.—The Cooler.

The Kiln.

The kiln is 231 ft. long by 8 ft. 6 in. diameter, enlarged to 10 ft. diameter in the burning zone. It is supported on five cast-steel tyres and is driven by a 100-h.p. motor. The kiln has a maximum speed of 1·3 revolutions per minute. Its weight, when fully loaded, is about 600 tons. The kiln is fired by a No. 18 Atritor which is capable of drying and producing pulverised fuel at a rate of 12,000 lb. per hour.

Air for combustion is obtained by a Keith Blackman induced-draught fan,

which rotates at 400 revolutions per minute, is driven by a 100-h.p. motor, and is capable of supplying 70,000 cu. ft. of air per minute at a temperature of 450 deg. F. This fan exhausts the kiln gases through a flattened-tube type electrostatic precipitator of similar capacity. The precipitator operates at 60,000 volts, and reduces the dust content to 0·4 grain per cubic foot at normal temperature and pressure before the gases pass to the reinforced concrete chimney which is 200 ft. high. The clinker passes through a rotary cooler 82 ft. 6 in. long by 6 ft. 4 in. diameter (*Fig.* 4), where its temperature is reduced to about 1400 deg. F. before being delivered to a 12-in. continuous-bucket elevator and an 11-in. conveyor which conveys it to the main store. The main clinker store is served by two overhead travelling cranes of 5 tons capacity which distribute the clinker to the grinding mills.

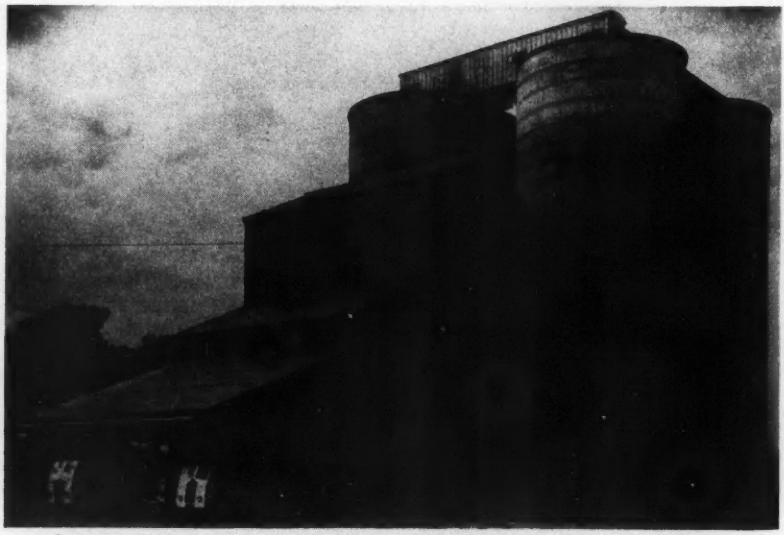


Fig. 5.—The Silos and Packing Department.

Clinker Grinding Mills.

There are two clinker grinding mills. One mill is 7 ft. 3 in. diameter by 34 ft. long and is driven by a 700-h.p. auto-synchronous motor, through reduction gears, at 20·5 revolutions per minute; this mill has an output of about 12 tons per hour. The other mill, 6 ft. diameter by 36 ft. long, is driven by a 550-h.p. auto-synchronous motor at 26·5 revolutions per minute and has an output of about 9 tons per hour. Gypsum is added to the clinker as it is delivered to the mill. The clinker is delivered, through air-slides, to a 7-in. Fuller-Kinyon pump which is capable of transporting 30 tons of cement per hour through a 5-in. pipe a distance of 500 ft. to the storage silos.

Storage Silos.

The four silos are of reinforced concrete. They are 85 ft. high by 30 ft. diameter, and have a total capacity of about 9000 tons. Cement is extracted from the base by air-slides and screw conveyors, which deliver to a hopper immediately above a Daylor four-spout packer. This machine is capable of packing 60 tons of cement per hour in 1-cwt. bags, which are conveyed by retractable conveyors to road vehicles. Arrangements are also made for delivering loose cement from the silos.

Water is obtained from a well in the former power house, and a reinforced concrete reservoir with a capacity of 70,000 gallons has been constructed. Electric power is purchased. The supply is 11 kV., and is transformed to 3 kV. and 415 volts. The total power requirement of the new equipment is 3000 h.p., of which 1860 h.p. is on the 3 kV. supply and 1140 h.p. on the 415 volts supply. Maximum demand is about 2250 kVA. with a load-factor of about 80 per cent. and a power-factor corrected to 0·96 lag.

Blastfurnace Cement.

ACCORDING to British Patent No. 672,137 (Soc. Anon des Fonderies, Laminoirs & Ateliers de Biache St. Vaast), blastfurnace slag or similar material is powdered and formed into a paste with water and is then subjected to the passage of direct current in order to cause it to set like cement. The treatment can be carried out in situ and continued until setting has taken place or can be effected for a time only in the mixer, setting being then allowed to occur naturally. The cathode or cathodes are immersed in the paste and may be left after setting, and the anode or anodes, formed of an inert material such as graphite or magnetite, are outside the paste, preferably in water surrounding a porous partition enclosing the paste; running water may be employed to remove any undesirable anions released by the electrolytic treatment. The paste may contain other inert materials such as sand or gravel, and the gauging water may include one or more electrolytes capable of releasing alkali- metal- or alkaline-earth metal ions, for example, sodium or calcium chloride or gypsum; sea-water may therefore be used. The process may be carried out in a mixer in which the mixing-blades may constitute the cathodes, while the anode is constituted by a perforated plate surrounding a porous ring resting on the bottom of a mixing-vessel and serving to retain the mixture.

Transport of Loose Cement.

It is reported in " Cement " (published in Amsterdam) that for the transport of loose cement horizontal containers as shown in *Fig.* 1 are replacing smaller vertical containers, which were generally mounted in pairs on a lorry. The reason for the change is said to be the greater stability. The containers have capacities from 6 tons to 14 tons ; they can be emptied at a rate of 80 to 100 tons per hour by pneumatic means. The container shown in *Fig.* 2 is for use on railways, and has a capacity of 40 tons.

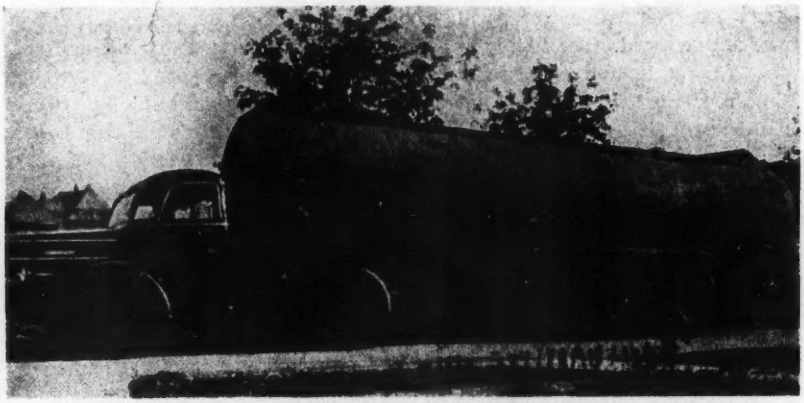


Fig. 1.—Cement Container for Road Transport.

Fig. 2.—Cement Containers for Rail Transport.

The Chemistry of Cement and Silicates.

The following is from the report of the Building Research Board for the year 1953 (published in June 1954).

In previous reports reference has been made to the importance of the system $CaO—MgO—Al_2O_3—SiO_2$ in the study of cement and slags. As part of the long-term investigation of this system, the revision of the system $CaO—Al_2O_3$ has been in progress for some years. This will be greatly aided by a technique which has been developed, on the basis of work at the U.S. Bureau of Standards, for following the process of melting and crystallisation of a heated specimen by direct microscopical observation. The method is extremely rapid in comparison with the usual quenching procedure, and in the system referred to has helped in ascertaining the unusual conditions governing the formation of the compound $12CaO.7Al_2O_3$. Composition in this region is of particular importance in the constitution of both Portland and high-alumina cements.

Studies on the equilibrium between anorthite and spinel in the quaternary system are almost complete. This region is of more importance in the study of blastfurnace slag. A point of general interest in the experimental technique of high temperature work is that thermocouples of 20%Rh-Pt/5%Rh-Pt were used instead of the orthodox 10%Rh-Pt/Pt for temperature measurement. The stability of this couple was found to be greatly superior to that of conventional thermocouples, the calibration remaining almost unaltered by more than a thousand hours' use in the region 1400 to 1700 deg. C. This enabled the very long heat-treatments required in the system under examination to be undertaken with greater accuracy.

Some progress has been made with the single-crystal X-ray study of the "unstable $5CaO.3Al_2O_3$" phase of high-alumina cement, of which the unit cell and space group were reported in the 1952 Report. It has been possible, by the interpretation of a Patterson vector map, to postulate a structure which appears to contain both tetrahedrally and octahedrally co-ordinated aluminium ions. The contents of the unit cell of this postulated structure are in close agreement with the formula $6CaO.4Al_2O_3.MgO.SiO_2$ deduced from phase studies.

Phase-rule studies are being undertaken on the general system cement-water in order to throw more light on the solid phases which may be formed in hydrated cement and to understand in greater detail the setting and hardening processes in hydraulic cements.

Work at Birkbeck College on the hydration of Portland cement has been continued, although on a reduced scale. Detailed studies have been made on naturally-occurring hydrated calcium silicates which are related to the products formed during the setting of cement.

Estimation of Silica Content.

THE following method of the colorimetric estimation of small quantities of silica by a kinetic method is described by M. J. Lafuma in "Revue des Materiaux" for October 1953.

Silica in an acid medium forms a yellow complex silicomolybdate with ammonium molybdate, but the colour is too feeble for colorimetric estimation when the silica content is small. Moreover, the colour is completely masked in the presence of phosphorus by the yellow complex phosphomolybdate. The silicomolybdate can, however, be reduced to molybdenum blue by sodium bisulphate at pH 2·7 to 3·0 without reduction of ammonium molybdate, phosphomolybdate, or even arsenomolybdate. The rate of development of blue coloration is a function of the silica concentration, the concentration of the other reactants, the pH, the temperature, and the oxidation-reduction potential.

In the kinetic colorimetric method two emergent intensities I_1 and I_2 at fixed wavelength are determined at two set times t_1 and t_2 under constant conditions. At time t_1 the incident intensity is $I_1 e^{klc_1}$ and at time t_2 it is $I_2 e^{klc_2}$ by the Beer-Lambert law, where l is the depth of the cell, c_1 and c_2 are concentrations of molybdenum blue at times t_1 and t_2, and k is a constant depending on the wavelength and the coloured substance. The ratio $\frac{I_1}{I_2} = e^{kl}(c_2 - c_1)$ is dependent only on the rate of change in concentration of molybdenum blue, and this depends on the silica concentration. The ratio is independent of the incident intensity, and this can be varied for maximum sensitivity.

The method eliminates absorptions due to other substances present, provided that they are constant. If they vary they can be found from curves of absorption at different times compared with similar curves for standard silica solutions.

The Efficiency of Boilers.

MEANS of saving fuel by increased efficiency are dealt with in "Industrial Boiler-house Efficiency," by Chas F. Wade (London: Crosby Lockwood & Son, Ltd. Price 15s.). The author formerly held the position of construction engineer with Messrs. Vickers, Ltd., of Sheffield, and was a lecturer on fuel economy with the Ministry of Fuel and Power. The chapters are: Fuels; Heat; Combustion; Furnaces and firing equipment; Firing methods; Boiler-house instruments; Boiler feed and feed-water; Steam boilers and heat insulation; Boiler auxiliaries; Boiler brickwork and settings; Steam demand and fluctuating loads; Thermal storage; Boiler-house records and record keeping; Boiler-house management.

New Cement Works near Mombasa.

The new cement works at Bamburi, near Mombasa, is nearing completion. The works is estimated to cost £750,000, and the raw materials will be coral and clay. The capacity will be 120,000 tons a year, which may later be increased to 250,000 tons a year.

Determining the Water Content of Slurry.

WHAT is claimed to be a rapid and accurate method of estimating the water content of raw cement slurry by means of a " curve-consistometer " is described in " Zement-Kalk-Gips " for February 1954. The following is a summary of the article.

If slurry is placed on a non-slippery inclined plane it moves downwards in a manner which produces forces of internal friction. Forces causing the downward motion depend on the gradient. If the gradient is gradually decreased, the rate of movement decreases until it becomes zero when the downward forces are balanced by the forces of internal friction. The gradient is therefore a measure of the internal friction or consistency of the mass.

The most efficient shape for a curve-consistometer is the quarter perimeter of an ellipse with the imaginary longer principal axis horizontal. The elliptical surface is in the form of a shallow channel provided with a fulcrum so that it can be tipped through 90 deg. to bring the shorter axis horizontal, and it is in this position when the lower end is charged with slurry. It is then tipped back through 90 deg. for flow to commence.

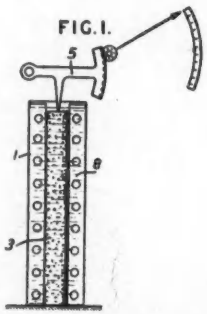
To charge the apparatus, the channel is blocked at the zero point by a rubber disc. Slurry is poured in and levelled with a knife. The disc is then removed and the channel tipped through 90 deg. A scale at the side of the channel gives the angle from the vertical at any point, and this is read as degrees of consistency at the point where the slurry comes to rest. Water content is plotted against degrees of consistency. For the range 30 to 45 per cent. of water this is always a straight line, but the line obtained depends on the nature of the raw material. A small change in the water content of the slurry results in a large change in consistency, so that the apparatus is very sensitive.

Reducing the Water Content of Slurry.

A British Patent (No. 668,550) has been granted to C. E. Every and F. L. Smidth & Co. for a method of reducing the water content of raw cement slurry by adding thereto one or more alkali metal phosphates. In addition, one or more of the carbonates and hydroxides of the alkali or alkaline earth metals may be included ; also sulphite lye or sodium silicate separately or in combination. Specific additions are sodium and potassium metaphosphates, sodium dihydrogen phosphate, disodium hydrogen phosphate, trisodium phosphate, sodium hexametaphosphate, sodium pyrophosphate, sodium carbonate, and calcium and sodium hydroxide. The total amount added is 0·2 per cent by weight. Lime slurries may also be similarly treated. According to the provisional specification the phosphate need not be present.

Testing the Expansion of Cement.

FIG. I.



A method of measuring the expansion of cement by means of a modified Le Chatelier test has been described in a British Patent specification. The test is carried out by supporting mortar prisms (3), *Fig.* 1, in a container (1) for boiling water, ribs (8), apertured to permit the passage of the water, serving to prevent sagging of the prisms. A measuring-device (5) to indicate the expansion is provided.—No. 653,839. G. Walter.

Cement Works in Jordan.

A cement works at Fuheis started production in February last. Its output is sufficient to supply all the requirements of the country.

Cement Production in Nyasaland.

Production at the Chilanga cement works in Nyasaland will be increased to 15,000 tons a month when the second unit of the factory is put into operation in 1956. The extension, which will have twice the capacity of the present works, is under construction at a cost of £320,000. The production of the present factory is 6,000 tons a month, and it is estimated that the total requirement of the territory is 20,000 tons a month.

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